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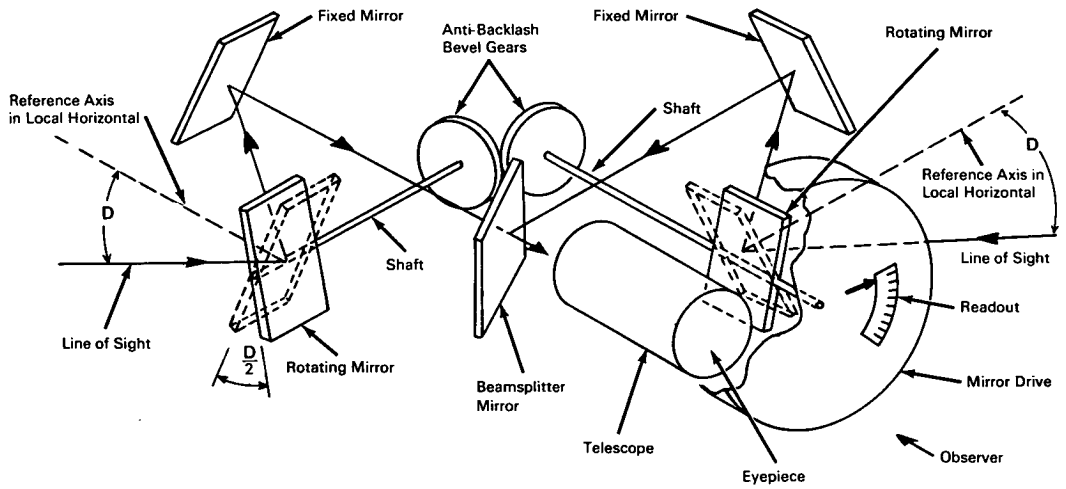
Brief 66-10143

# NASA TECH BRIEF



## Sextant Measures Spacecraft Altitude Without Gravitational Reference




### The problem:

To measure the altitude of an orbiting spacecraft (in a gravitationless field) above a planet's surface. Conventional horizon-sensing instruments, which have been used to measure altitude without recourse to a gravitational reference, require either observation along four lines of sight in two orthogonal vertical planes or mechanical scanning of large arcs of the horizon.

### The solution:

A horizon-sensing sextant that operates without reference to a gravitational field by optically measuring the dip angle to the horizon along a line of sight in each of two planes. Horizon-scanning is accomplished over a relatively limited field of view (45° to 90°).

### How it's done:

The sextant measures the dip angle, D, below the local horizontal in two intersecting vertical planes which are separated by a fixed dihedral angle (equal to the angle between the axes of the two shafts on which the mirrors rotate). Accurate setting of the dip angles is accomplished by simultaneously rotating the two mirrors on the bevel-geared shafts until the two lines of sight, lying in the local horizontal plane, merge into one line, through the telescope. The dip angle through which both mirrors have been rotated is determined by the shaft angle, D/2, with respect to the frame of the sextant. The dip angle scale on the sextant may be calibrated to give direct readings of the altitude.

(continued overleaf)

**Notes:**

1. This sextant should have application in situations where only a narrow field of view is visible or where conventional horizon-sensing instruments are unsatisfactory.
2. A novel feature of this sextant is its ability to establish the true direction of the local optical vertical. The marine sextant can measure only an angle, which may not necessarily be in a vertical plane, and the bubble sextant can measure only an angle in a single plane containing the local gravity vertical.
3. The telescope can be eliminated by using concave mirrors for the rotating elements to form real images of the horizons which would be superimposed by the beam splitter.
4. The instrument can be easily modified to measure attitude angles of the vehicle with respect to the local vertical.
5. Inquiries concerning this invention may be directed to

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas, 77001
   Reference: B66-10143

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

Source: Geonautics, Inc.
under contract to
Manned Spacecraft Center
(MSC-200)